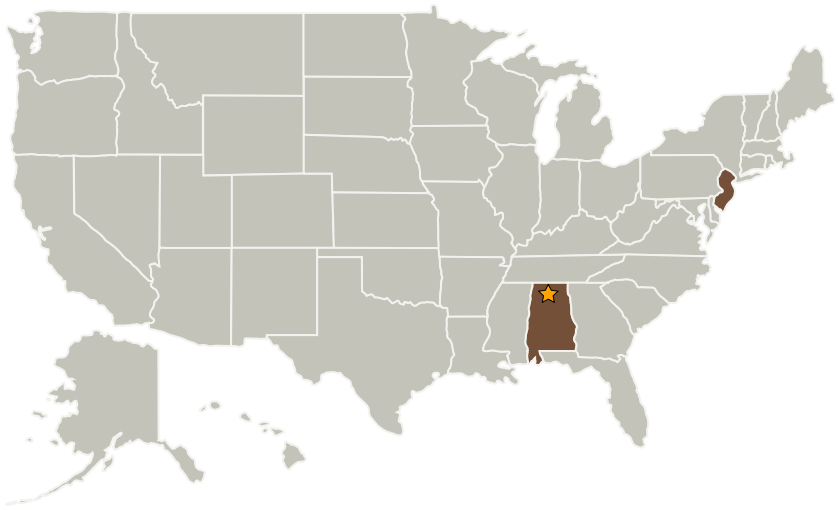
A Non-Volatile SRAM For Spaceborne Applications Using a Novel Ferroelectric Non-Linear Dielectric, Phase I

Completed Technology Project (2006 - 2006)

Project Introduction

A ferroelectric non-linear dielectric was recently discovered that, in their film form, possess a number of properties that make it an excellent choice for radiation-hardened electronics, particularly a radiation hardened (total dose hardened and SEE immune) non-volatile (NV) static random access memory (SRAM). Electrical measurements of these films demonstrated a relatively low dielectric constant (~20), an inherent ability to form a native buffer layer when deposited directly on silicon, and a strong polarization hysteresis effect. These results indicate that this film may be used to replace the two n-channel and two p-channel transistors in a traditional 4-T SRAM latch cell with two n-channel and two p-channel non-linear dielectric field effect transistors (NLDFETs). The threshold voltage hysteresis effect of the NLDFET should achieve full SEU immunity to at least 80MeV-cm2/mg of ionizing radiation, when used in a standard 6-transistor SRAM cell structure, thus have ultra-fast access times (like commercial SRAMs) while offering full non-volatility. In Phase I we will provide the device proof of concept, then in Phase II build a prototype memory. Phase III will see commercialization by licensing and sales. The resulting NV-SRAM products have the potential to be orders of magnitude faster than any existing EEPROM or FLASH devices because the nonlinear dielectric film forms a native dielectric with silicon giving the structure resistance to "wear-out" or "data-retention" problems. Finally, the SMI material is fully compatible with CMOS processing and has been accepted into major commercial silicon fabrication lines as a high-k dielectric for linear applications.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Structured Materials Industries, Inc.	Supporting Organization	Industry	Piscataway, New Jersey

Primary U.S. Work Locations	
Alabama	New Jersey

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.1 Avionics Component Technologies
    - TX02.1.1 Radiation Hardened Extreme Environment Components and Implementations